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EDITORIAL

WILLIAM HARVEY

In the month of June of this year medical men and workers in the various ancilliary disciplines gathered together in England, his native land, to commemorate the life and work of William Harvey. Harvey died on June 3, 1657. He was nearly 80 years of age and the accounts of his fatal illness indicate that the cause of death was centred in the cranium and there was interference with the free passage of the blood in the circulatory system.

Like many other eminent medical men his death was due to a lesion in a part of the body upon which he was a prominent authority. He had done more than any other man to disclose and explain the wonders of the vascular system. Like many other resounding discoveries in all spheres of endeavour his was delayed for many years awaiting the arrival of one who had eyes to see and recognise the portent of something which others had passed by.

Those who "come after" great events may wonder why such apparently obvious things could have escaped previous notice and comment. Over the centuries men of equal and sometimes greater academic merit, according to the measure of their time, and fully conversant with the gross structure of the heart and the design of the vascular system, had gazed and cogitated without reward other than that which is based on philosophical speculation. All things are relative to their time and place, and one must remember that the medical men of the seventeenth century still sheltered in the shades of Galen and Hippocrates whose humoral theories were accepted without question as were the laws of the Medes and Persians in more ancient times.

(*The June issue of The British Veterinary Journal was published on June 26th*)

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Astrology still played an important part in the art of diagnosis, witches cursed and charmed, dangerous miasmas polluted the air, spirits flitted hither and thither in the great arterial tunnels and decoctions of frogs, toads, worms and sheep's eyes were favoured agents in therapeutic armamentarium. We must remember also that the surgeons were the only men who viewed the living tissue beyond the skin, and by the hazards of the craft their field was a restricted one. In most cases the surgeon was a crude technician of meagre academic status who performed his gruesome task at the behest of and under the instruction of and/or supervision of a physician.

Harvey's discovery had a greater impact and influence upon the advancement of the healing art and science than that of any other time, including the present. It marked a tremendous change, a revolution in which philosophy lost its pride of place, usurped by science. The new concept was so startling that many famous physicians could not accept Harvey's statements and ideas. Harvey had been educated in the traditional way, and one may suspect that he might have been troubled with doubts as to the correctness of his own assumptions. A period of twelve years elapsed before he published the full account of his work and observations. He did not rank amongst his peers as a great physician, and probably that is the reason why his book was printed and published in a foreign clime. Harvey's discovery may not have received universal approbation at the time, but the truth of his work prevailed and became an essential corner stone for all subsequent advances in medical knowledge. He may not have ranked as a famous physician in his time, but temporary fame is elusive and of little consequence for it can depart as quickly as it comes. As the years have gone by Harvey has attained a place amongst the immortals as one of the world's great men. We should be proud that he was an Englishman, and it is right that we should bear him in honoured memory and revere his name.

GENERAL ARTICLES

MILK FEVER, POST-PARTURIENT PARALYSIS AND LACTATION TETANY

By CHARLES WEIGHTON, M.R.C.V.S.
Lincoln

MILK fever and similar diseases of the cow have been treated for many years with such success that it might be assumed that there is now nothing more to be learned about them; much attention, however, is being given by research workers to mineral metabolism in the dairy cow, and our knowledge in this wide field is still far from complete.

I have kept the clinical histories of a number of selected cases where perhaps an accurate diagnosis has been more difficult than usual, and have arranged them in their various categories on clinical diagnosis.

Blood samples were taken from these animals for the determination of serum calcium, magnesium and acetone, and blood inorganic phosphorus. In the majority of cases the results obtained confirmed the diagnosis based on the clinical findings. All cases in which the serum calcium shows the greatest departure from the normal level are described as milk fever cases; those which show a fall in the blood inorganic phosphorus as the chief upset are classified as post-parturient paralysis cases (C. Weighton, 1942) and those on which the imbalance is primarily a *hypomagnesæmia* as lactation tetany cases.

Milk Fever

One case was seen in January, two in March and one in each of the months of June, August and November.

These cases have been recorded and tabulated (Table I) so that they may be compared and contrasted with the findings in the post-parturient paralysis cases.

Blood analyses showed that the average calcium level for the six milk fever cases was 4.4 mg. p.c. serum. In milk fever cases it is usual to find normal or slightly elevated serum magnesium values (W. M. Allcroft, 1947). The average in these cases was 2.6 mg. p.c. serum.

The acetone values were normal in all six cases.

In typical cases low blood inorganic P values are usually found (Fish, 1929). The average for these cases was 1.6 mg. p.c. blood.

Milk fever cases usually respond well to calcium boro-gluconate given either intravenously or subcutaneously. When given subcutaneoously the fluid should infiltrate and disperse readily. Before withdrawing the needle it is advisable to squeeze a quantity of penicillin in oil into the subcutaneous tissue. The usual dose of calcium boro-gluconate solution used is 120 grammes in 400 ml. of water. This is an adequate dose for most of the typical cases.

The amount given intravenously and/or subcutaneously depends on the severity of the case.

A case which shows a slow response to calcium therapy should not be given a magnesium injection, as in the absence of tetany it is more likely that the case is primarily a hypophosphatæmia, and therefore in spite of treatment the cow may remain down for two or three days.

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A *hyper*magnesæmia is common in cases of hypocalcæmia (W. M. Allcroft, 1947). Illness may therefore be prolonged by magnesium treatment.

SUMMARIZED DATA ON SIX MILK FEVER CASES (TABLE I)

Calcium, magnesium and acetone values are expressed as mg. per 100 ml. serum; inorganic phosphorus as mg. per 100 ml. blood.

Case reference	Date of parturition	N. of parturitions	Symptoms	Blood Analysis				Treatment	Response	Remarks
				Ca	Mg	Acetone	I.P.			
A.3 Friesian 18/8/51	17/8/51	6	Temp. 101.0°F Pupils normal Making attempts to rise.	7.1	3.1	Normal	2.3	400 ml. calcium boro-gluconate solution (120 gr) i/v and 400 ml. of a proprietary mixture of calcium boro-gluconate and phosphate intravenously.	Up in 20 minutes	
A.10 Friesian 29/3/53	29/3/53	4	Temp. 101.0°F Pupils contracted no response to light. Semi-comatose when seen 9 hrs after calving	3.5	2.6	Normal	1.5	400 ml. of a proprietary mixture of calcium boro-gluconate and phosphate intravenously.	Up in 6 hours	
A.13 Ayrshire 3/11/53	3/11/53	4	Temp. 101.5°F Pupils normal but showed no response to light. Respiration accelerated.	3.6	2.2	Normal	1.0	8 a.m. Calcium boro-gluconate 400 ml. and 400 ml. of proprietary mixture of calcium borogluconate and phosphate. i/v. 3 p.m. 300 ml. calcium boro-gluconate subcutaneously. Acid sodium phosphate (total 3 ozs) was given by mouth over period of two days.	3 p.m. The cow was then on her brisket. The cow did not get up till 6 p.m. on 8th November.	
A.18 Ayrshire 17/1/54	16/1/54	6	(1) Unsteady at 8 a.m. (2) Down and unable to rise by 11 a.m. Temp. 100.4°F. Pupils dilated.	6.1	2.9	Normal	2.4	11 a.m. Calcium boro-gluconate 300 ml. intravenously and 100 ml. subcutaneously Next day (18th) calcium boro-gluconate 400 ml. intravenously.	Up on the morning of the 19th, 44 hrs. after the first injection.	
A.19 Guernsey 4/3/54	2/3/54	5	8 a.m. Down and unable to raise head. Temperature 99.8°F. 12 noon Temp. 100.4°F.	3.1	2.9	Normal	0.9	8 a.m. Calcium boro-gluconate 400 ml. intravenously. 12 noon. No further treatment considered necessary.	Up in 4 hours, immediately after second visit.	
A.26 Friesian 6/6/56	5/6/56	8	Temp. 100°F. Pupils dilated. Down on side and just able to sit on brisket. Increased respiration and groaning.	3.1	2.2	Normal	1.5	200 ml. calcium boro-gluconate (60 gm) intravenously and 200 ml. subcutaneously.	Up in 15 minutes.	

Case *A.3* was up in 20 minutes.

The second case (*A.10*) responded in six hours. It was diagnosed primarily as a hypocalcæmia. It is probable that an equally good response to treatment would have been obtained if calcium alone had been given.

The administration of phosphate in *A.13* both intravenously and by mouth did not appear to have hastened recovery as the cow did not respond to treatment for three days.

A.18 responded to calcium therapy and was up in 44 hours. She was down with post-parturient paralysis in February, 1951 (A.2—Table II). At her next two calvings in February, 1952 and December, 1952, she received prophylactic injections of calcium boro-gluconate (400 ml.) three hours after calving with apparent success since she progressed satisfactorily after both. I have found prophylactic injections most useful.

A.19 was up in four hours, having made a good recovery without phosphate

therapy even though the blood inorganic P value was the lowest of this series.

A.26 which had low serum calcium and low inorganic P values responded to calcium therapy in 15 minutes.

In the first three cases treatment consisted of a proprietary mixture of calcium boro-gluconate and phosphate, and in the second three calcium boro-gluconate alone.

The results do not indicate that the administration of phosphate has any advantages.

It seems that only a small percentage of milk fever cases benefit appreciably from the administration of phosphate. Perhaps there is the particular case which would benefit if it could be recognised clinically.

Whilst it would seem reasonable to make good the blood P shortage, nevertheless, in the majority of cases, calcium alone gives the results required by the clinician. In my experience the nearer the case is to a typical milk fever one the less the necessity for phosphate.

Post-parturient Paralysis

Four cases which come under the heading Post-parturient Paralysis are recorded (Table II).

This description is given to those cows which are recumbent just after calving at the same time as milk fever would be expected to occur.

In such cases the animal appears normal, but it cannot get up; the temperature is normal, the cow will often eat and drink, the bowels are in a normal state, and the pupils are often normal or they may tend to be contracted rather than dilated as is usual in most milk fever cases.

These cases are most likely to be seen during the winter months when the vitamin supply can be expected to be at its lowest.

Three cases were encountered in November and one in February.

The interpretation of the blood picture indicates that the condition is primarily a hypophosphatæmia, although the actual fall is less than in milk fever cases. The average is about 2 mg. per 100 ml. serum.

As a rule—the calcium value falls only by 25 per cent—the average for the four cases described was 7.0 mg. p.c. serum, and the average for three of them was 7.7 mg. p.c. serum, which is above the range for milk fever cases.

The magnesium value was 2.3 mg. p.c. serum. This is within the normal range, but below the average value for milk fever cases.

A.2 did not respond until *44 hours* after the initial treatment.

A.4 was up in 24 hours after stimulant treatment only had been given per orem.

The symptoms and chemical data of cases A.2 and A.4 were similar, yet to all intent case A.4 made a spontaneous recovery.

A.14 was on her feet in *10 minutes* in spite of the hypophosphatæmia, and the mild hypocalcæmia, plus an unexpected hypomagnesæmia.

In A17 the calcium value was lower than expected and comes within the milk fever range, but the cow was down for *two days* as expected.

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Post-parturient paralysis cases in which the chief blood abnormality is a low inorganic P value, frequently make a slow recovery, and stimulant treatment is probably the best method of dealing with them.

Calcium seems to be of little value, but the administration of phosphate does not always hasten recovery in spite of the hypophosphatæmia which I do not consider to be the sole cause of the illness.

SUMMARIZED DATA ON POST-PARTURIENT PARALYSIS (TABLE II)

Case reference	Date of parturition.	No. of parturitions.	Symptoms & Prognosis.	Blood Analysis				Treatment	Response	Remarks
				Ca	Mg	Acetone	I.P.			
A.2 Ayrshire cross. 24/2/51	21/2/51	3	Temp. 102.2°F. Pupils normal Bowels normal Making attempts to get up. Expected to be down 2 to 3 days	7.5	2.6	Normal	1.7	11 a.m. 300 ml.(90 gm.) calcium boro-gluconate intravenously and 400 ml. of a proprietary mixture (at 4 p.m.) of calcium-boro-gluconate and phosphate, acid sodium phosphate 6 drachms by mouth, then two drachms night and morning.	The cow was up in 44 hours.	
A.4 Friesian 14/11/51	14/11/51	6	Paralysis but otherwise normal and making frequent attempts to rise. Temp. 101.5°F. Expected to be up on 14th.	7.5	2.9	Normal	2.4	Stimulant treatment only by mouth	Cow up and normal on the 15th.	
A.14 Lincoln red. 15/11/53	14/11/53	4	Down and unable to rise. Temp. 101.4°F. Bowels normal. Rumination suspended and food refused.	8.0	1.5	Normal	1.8	Calcium borogluconate 200 ml (60 g.) and 400 ml. of a proprietary calcium borogluconate and phosphate intravenously.	Up in 10 minutes.	The rapid recovery was unexpected.
A.17 Lincoln red. 30/11/53	29/11/53	5	Paralysis. Temp. 101.0°F. Pupils contracted and food refused. Expected to be down 1 to 2 days.	5.5	2.3	Normal	2.4	10 a.m. 30/11/53 400 ml. proprietary mixture dextrose and phosphate intravenously. 5 p.m. 400 ml. calcium boro-gluconate intravenously. 1/12/53 Proprietary mixture calcium boro-gluconate and phosphate intravenously.	Cow was up on Dec.2nd.	

Lactation Tetany

In lactation tetany cases the primary disturbance is a hypomagnesæmia, but there is usually a moderate fall in serum calcium (W. M. Allcroft, 1947). Table III.

As a result of the concomitant fall in calcium it is advisable to administer, by intravenous injection, calcium boro-gluconate in conjunction with a solution of magnesium sulphate. The quantity of magnesium sulphate administered will vary with the case, but it is customary to give acute cases 45 grammes in 400 ml. warm water, and 60 to 120 grammes calcium boro-gulconate in an equal quantity of water.

It is my custom to give the magnesium sulphate solution first, and according to the case, regulate the quantity given by noting the animal's response. This will be observed most readily by a relief of the tetanic symptoms, and/or a gradual approach from rapid towards normal respiration. As a rule the prognosis is grave in lactation tetany unless an early improvement is shown, i.e., immediately after treatment. If the cow will sit on her brisket within an hour one should persevere with the treatment of the patient.

One case (not recorded) that was down in an acute attack, stretched on her side and unable to raise the head, made quite a good response and was sitting up within two hours, yet she remained down for nineteen days.

Results vary particularly with the season, but I believe that cases where a marked fall in serum magnesium has occurred give the best response. I have observed also that the most severe clinical symptoms may not be associated with the lowest serum magnesium levels.

Although the ætiology of the disease remains obscure, there is considerable satisfaction in knowing that a large percentage of cases can be treated satisfactorily. There is little doubt, however, that every year a large number of acute cases are found dead, and usually nothing is done to find out the cause of death.

It appears that there is something more than serum magnesium to be considered in trying to arrive at the cause of this disease as it is generally accepted that it is not a shortage of magnesium in the diet that precipitates the attack.

SUMMARIZED DATA ON LACTATION TETANY CASE (TABLE VII)

Case reference	Date of parturition.	No. of parturitions	Diagnosis and Symptoms	Blood Analysis.				Treatment	Response	Remarks
				Ca	Mg	Acetone	I.P.			
A.21 Ayrshire 29/10/54	13/10/54	4	A typical clinical lactation tetany case. Appreciable fall in serum magnesium and a moderate fall in serum calcium expected.	6.3	0.6	Normal	1.7	400 ml. solution of magnesium sulphate (45 gm) and 400 ml. of calcium boro-gluconate intra-venously.	Up and normal in one hour.	The low inorganic P. value is not quite typical. Although the inorganic P value was also low a good response was obtained to magnesium and calcium therapy only.

Lactation Tetany

Methods of preventing lactation tetany are perhaps more important than in either of the other two conditions because of the large number of acute cases, and the higher death rate. Prevention has been discussed in a recent article by R. Allcroft (1954).

I wish to acknowledge the help of the Biochemical Department of the Veterinary Laboratory at Weybridge.

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SOME PROBLEMS OF COLONIAL ANIMAL HUSBANDRY PART 1

The Northern Frontier Province of Kenya

By W. M. McKAY, Ph.D., M.R.C.V.S.

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THE following paper was written before the late war, but at the request of the Colonial Office its publication was withheld during the war years because at that time information, such as this paper set forth, might have been of use to the enemy.

The problems of Colonial Animal Husbandry are many and varied and the difficulties in the way of progress are numerous. Some of these problems can be controlled or eliminated, some are beyond the reach of modern knowledge and as yet many are imperfectly understood.

In the Northern Frontier Province of Kenya, comprising an area of approximately 100,000 square miles of imperfectly known country, the conditions generally are particularly inhospitable for stock. Variations do, of course, exist, and such local variations have an important bearing on the management of stock.

The two extremes might be considered to be the Leroki Plateau, not unlike some areas of Speyside in Scotland, and the Garissa district on the Tana River which, apart from the river-side vegetation, is dry and arid in the extreme.

The Leroki Plateau rises to a height of some 6,000 feet above sea-level, while the Garissa district has an altitude between 100 and 200 feet. In the tropics, such a difference in altitude causes a marked variation in the vegetation, rainfall and temperature.

The two areas will be considered separately.

(A) The Samburu Area

This area includes the Leroki Plateau and has low lands which approximate in altitude to those of Garissa.

A census of the cattle population was carried out by me in 1932 and found to total some 130,000 head; of these, some 70,000 were on the Leroki Plateau which measures about 100 square miles in extent and is comparatively free of "fly". This native area, like the Garissa area, has the advantage of being bounded by a permanent river along one border. This river of the Samburu, the Uaso Nyiro, is met at the border at an altitude of 3,600 feet, and here the grazing is scanty, the soil a very sandy red loam and the vegetation mainly bush with wild fig and acacia trees along the river banks. This river flows in an easterly direction to disappear blindly in the Lak Dera.

Leaving the river, the country is flat for miles. Grazing during part of the year is practically non-existent. Some 10-12 miles East, at an altitude of about 4,200 feet, the grazing is better and the predominant grass is a variety of star grass (Cynodon *plect*).

Cynodon Plectostachyum has recently been subjected to extensive trials in

South Africa, Australia and India, but judgment is in abeyance meantime pending an elucidation of its possible toxicity because of its HCN content.

The approach to the Plateau begins at the Lumluti Escarpment—a series of steep ascents with only slightly less precipitous descents, terminating in a steep ascent to the Plateau itself. The area of the Escarpment is dry; vegetation is sparse and consists of thorn bush, acacia, fig and euphorbia trees. The soil is apparently granitic in origin and its capacity for maintaining stock is very poor, probably no better than one ox to 40 acres; but at times, it is made to carry about one animal to four acres or less. The rainfall is scanty and streams exist which flow only during the rains and remain for the rest of the time as dry beds, in which the stock-owners dig holes for the collection of water.

On the Plateau itself the rainfall, vegetation and soil conditions are decidedly better. Here the herbage consists chiefly of Oat grass (*Themoda triandra*) and Star grass. The terrain is undulating, dotted with olive trees in the hollows and thorn trees and Oat grass on the ridges. As the high areas are reached, olive and cedar trees are abundant and Star grass grows well. Water is more plentiful in wells and water-holes. At Lake Kisima there is a large expanse of mineral containing water of great value to the locality.

The Cattle Owners and Animal Husbandry

The inhabitants are the Samburu, a sept of the Masai left in this area when the tide of the Masai invasion from the South receded, and in some areas the Turkana, a tribe with distinct indications of Egyptian influence at some time in their history. The Samburu are bright, intelligent people, whose whole lives are built around their stock. They are nomads and in the way of nomads, do not till the ground, so that mixed farming, such as, for example, the Kikuyu practise does not exist.

During the rains and for so long as available grazing and water last they remain in one area, but as soon as grazing becomes scarce they begin to move further afield and as water becomes scarce their movements are irresistibly drawn towards the permanent water.

They are good stockmen and recognise to the full the values of the different grasses in the herbage, and have a pronounced preference for Star grass. They have a great regard for their stock and know the qualities of each member of the herd. Some selective breeding is practised in a very minor degree, but generally speaking the bulls, cows and heifers graze together and haphazard matings result.

The Samburu and the Turkana exist solely on milk, blood and meat. Cereal food in the form of maize meal is purchased only occasionally and at long intervals or when issued as a Government ration. They are of good physique, and as warriors or " moran " they are capable of great endurance. Their period as warriors is of relatively short duration and they age rapidly, a feature common to most African tribes.

History of the Samburu Cattle

The Samburu cattle are of the *bos indious* type, of Asiatic origin, which have, in the course of centuries, diffused into most parts of the African continent. The " breed " is the result of a mixture of types, with the Kenya Boran predominating.

Representatives of the Ankole cattle are not infrequent and result from the days of bartering before quarantines isolated the Northern Frontier Province. These Ankole stock would have originated in Uganda. Tribal wars in the past with the Suk and Turkana have resulted in a percentage of cattle from those areas being acquired by the Samburu. The predominant type, however, as stated above, is the Boran.

Performance of the Cattle

(a) *Growth.* The rate of growth is very slow. The average weight of newly born calves is 39 lb., and full growth is not attained until the cattle are between five-six years old. This extremely retarded growth rate is apparently due to a number of causes which may be summarised as follows:—

1. Breeding prematurely.
2. Insufficient nourishment during the dry season.
3. Hereditary characteristics.

Premature breeding has a permanent deleterious effect on the animals; not only is their growth checked but the female is scarcely, if ever, in a position to give sufficient milk to rear her first calf successfully, so that the majority of the cattle commence their existence under suppressed conditions of growth.

(b) *Sexual Maturity.* Sexual maturity occurs at a very early age, and although this fluctuates the average is from 12 to 15 months—most heifers calving down at about 24 months old. Bulls mature at a slightly older age.

(c) *Milk Yield.* Milking takes place twice a day—in the morning and evening. Only sufficient milk to satisfy the domestic requirements is taken; the remainder is left for the young stock.

The milk yield is low; a good animal will give up to 10 lb. of milk a day in her flush period during the rains. The average daily yield, however, is in the region of 6-7 lb. One-handed milking is practised. Once a heifer has been suckled by her calf she will rarely let down her milk at hand-milking without the presence of her calf. If a calf dies its skin is filled with grass and placed at the cow's head during milking, or if a young motherless calf is available the lochia is smeared over it and is then presented to the cow as her own.

The butter fat content is high as a rule, averaging about 5.5 per cent and ranging from 2.1 per cent to 7.9 per cent.

(d) *Beefing Qualities.* The Boran type bullock, though slow to reach maturity, has relatively good beefing qualities. At five-six years old they grow out to large animals carrying, in the grazing season, a good proportion of flesh. Deadweights vary from 480 lb. to 900 lb. liveweight. Cows kill out at about 300 to 320 lb. deadweight. Bulls go up to 1,300 lb. liveweight.

(e) *Calving Frequencies.* Although many cows calve annually, others calve only once in two or even three years. The average interval seems to be in the region of 18 months. This long interval between pregnancies seems to be a natural compensation for the poor environmental conditions.

Calves appear to be retained "in utero" for a longer period when calving is due to take place during the wet season. In addition, calvings are most frequent during the wet months, so that it would appear that fertility is at its optimum at a time which would coincide with calving when there is maximum grazing and milk yield. The minimum gestation period recorded was 267 days

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and the maximum 302 days. The average for 23 cows was 287 days. The average gestation period when the calf was a bull was 290 days and when it was a heifer, 283 days. Twin calves are very rare and probably do not occur oftener than once in a thousand calvings. Triplets are practically unknown, only one instance coming to my notice.

Breeding

Some selective breeding is practised. Only bulls from the best cows are kept for breeding purposes, the other males are either castrated at birth, when the testicles are removed, or as two-/three-year-olds when the operation is performed by crushing the spermatic cords between two stones.

Although the value of a bull from a cow with a good milking record is acknowledged, indiscriminate breeding occurs since, in most instances, the entire village herd grazes together. It is thus possible for father and daughter, son and mother and brother and sister matings to take place. Inbreeding is thus intense.

It is in this manner that the selective breeding fails to a large extent. The care given to the selection of the males is not applied to the females. Every female is regarded as a fit subject for the production of calves and is allowed to mate under uncontrolled conditions. Females of poor growth, of every type and condition are bred from with consequent herd deterioration. It is this aspect of herd management which urgently requires control and the castration of bulls is of relatively minor importance, even though uncastrated animals exist in far too great numbers proportionate to the needs of the herd.

An average herd of 224 animals, consisted of 20 bulls, 128 cows, 51 bullocks, nine heifer calves and 16 bull calves. Another herd consisted of 30 cows, 10 bulls, 21 bullocks and 15 calves of which nine were heifers. It will be seen that the proportions of bulls to cows and bulls to bullocks are much too narrow. No harm can be done by too many bulls provided always that they are properly selected and the breeding is controlled.

The dependence on milk for food has a very important influence on the breeding policy. The choice is limited to either breeding for individual high yielding cows or for numbers. As stock, and especially cattle, constitute the wealth of the owner—analogous to the coinage of civilisation—numbers become the main objective. Females are seldom disposed of and never used for food unless as a result of old age, infirmity or injury. This urge for numbers is the main cause of the difficulties. In obtaining numbers quality has had to be sacrificed.

Although this indiscriminate breeding is largely responsible for the more or less stationary position of livestock improvement, there are other forces at work which are also responsible for the existing low standard of performance. These environmental limiting factors may be summarised as follows:—

1. Prevalence of disease.
2. Quantity and quality of the food supplied.
3. Mineral deficiencies.
4. Water supply.
5. Tsetse fly belts.
6. Lack of outlets for stock.
7. Soil erosion.

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Limiting Factors

(1) *Prevalence of Disease.* The major endemic diseases of Africa are very prevalent in the area. Rinderpest is a frequent cause of decimation of the herds and a census taken of all the herds in the area showed that, on the average, 75 per cent of the individual members of each herd had been attacked with rinderpest.

Bovine pleuro-pneumonia is rife and is the main permanent cause of loss of cattle and about one-half of each herd had been at some time affected with the disease. Owing to the prevalence of chronic "carrier" cases, the disease is present constantly.

For the sake of illustration, the following figures for herds taken at random show the proportion of recovered rinderpest animals and apparent recoveries from contagious bovine pleuro-pneumonia:—

Herd	Total number in herd	Rinderpest recoveries	Pleuro-pneumonia recoveries
A	258	170	101
B	135	87	60
C	303	124	115
D	29	22	13
E	88	62	42

Trypanosomiasis is common in some districts, and for this reason these regions are avoided until lack of grazing forces the owners to drive their cattle to graze in tsetse fly areas. Accordingly, if, in the periods of drought, grazing (no matter how poor) exists in these fly areas and nowhere else, there is no choice between the certainty of death of the stock from starvation and the chance of trypanosomiasis.

Anthrax and black-quarter are endemic and are not greatly feared; the carcases are eaten by their owners with seeming impunity. Only once was a malignant carbuncle encountered in a native as a result of anthrax infection. Deaths in natives from anthrax infection, although they must occur, are so infrequent that they are not attributed to the meat eaten.

(2) *Food Supply.* There are two distinct but wholly interdependent aspects of this problem, viz.: (*a*) Quantity and (*b*) Quality of the food.

(a) *Quantity of Food.* Milk for Calves. As noted previously, the herd owners depend almost entirely on the milk supply for their nutrition. The amount of milk available for the calves, therefore, depends on the total milk supply and the requirements of the owner. Owners of large herds can usually treat their calves well; but calves in small herds frequently suffer from an actual shortage, especially during the dry seasons. A shortage of food at such a critical period is reflected in the animal being small and stunted throughout its whole life.

(ii) *Pasturage.* (a) Rainly seasons. In the rains the grass grows quickly and a few days after the rains break, a green tinge is seen over the dry pasture. There is a temporary luxuriant growth during the flush of the rains, but this soon disappears after the rains are over. During the flush period, herbage is profuse

and movements of the herds cease. The condition of the herds improves rapidly, there is milk for all needs and the surplus is manufactured into ghee, either in the villages or at the ghee stations erected by the Government

(b) Dry seasons. During the dry periods, which may last from four to five to twelve months, according to the locality, the herds pass through conditions of semi-starvation. The dry unpalatable herbage is eaten for want of better feeding, branches and leaves of trees are cut down for food and these are eaten together with the bark and beans and pods if available. The herds lose condition at the latter part of the dry season and milk is scarce. In areas where star grass is profuse, the herds apparently suffer less than is the case of those herds in localities where the herbage is chiefly oat grass.

The pasture and forage of the low area (3,500 to 4,000 feet) varies from area to area and depends very largely on the moisture conditions prevailing. The dominant tree is *Acacia mollifora* Benth, and this is believed to have some value as forage. The pasture consists chiefly of *Cynodon plectostachym* Pilg. Other species of grasses encountered are *Pennisetum ciliare* Link (*P. cenchroides* Pers.) and *Chloris myriostachya* Hochst.

On the higher lands of the plateau there is an abundance of trees, many of which appear to have some forage value. The main types are *Acokanthera schimperi* Schweinf, and *Euclea lanceolata* E. Ney. Acacia trees are found near water courses and prominent types were identified as Acacia Sp. near *A. gerrardii* Benth, *A. hebechladoides* Harms and *A. abyssinica* Hochst.

The pastures of this area consist mainly of *Cynodon plectostachym, Themeda triandra, Pennisetum masaicum* Stapf and *P. clandestinum* Hochst.

(b) *Quality of Food.* The quality of the pasture is good during the wet weather and many specimens of grasses were collected for identification and analysis, but the majority were accidentally destroyed. During the dry weather the quality of the grazing becomes very poor and within a comparatively short period of the cessation of the rains, the grazing is reduced to innutritious woody herbage, consisting of hard flowering stalks and withered leaves.

(3) *Mineral Deficiency and Quality of Food.* The fact that minerals are lacking in some of the pasture is recognised by the herds who take advantage of the various natural salt licks and salt water lakes. As noted previously, no official analyses have been made of the herbage, but it is obvious that it is lacking in minerals, and unless cattle have access to natural licks they soon lose condition. Herd owners who do not happen to be in the vicinity of a natural salt lick, habitually drive their cattle to the nearest one, at least twice a year. In addition, should the cattle become unduly unthrifty at any time of the year, a special journey is made. Usually a stay of about fourteen days is made at a salt lick or lake, and the cattle are reported to benefit greatly and rapidly. The Kisima lake provides the chief source of mineral supply for the herds on the Leroki Plateau. There are many indications that the cattle suffer from functional mineral deficiencies. The slow growth rate, late maturity, low milk yield, absence of normal ovulation and low birth rate, all point to deficiencies in the diet.

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(4) *Water Supply.* The meagre water supply is probably the greatest limiting factor. The rainfall rarely exceeds 20 inches annually in most areas, and it is usually torrential in character and results in a large waste "surface run off" water. In the majority of cases the rivers run for only a short time during and after the rains drying up very quickly afterwards. Cattle in grazing areas near water are watered every day, but others at varying distances from water are taken to water every two, three, four or even five days. In these cases the animals are driven considerable distances and consequently are almost constantly on the move.

The water shortage is acute in most areas in the dry season. Wells are dug in the beds of the dried-up rivers, troughs made of hollowed out tree trunks or of hide cradled on wood are used, and the water is rationed to each animal carefully. European cattle have been found to require four gallons of water for each gallon of milk produced; and it is unfortunate that analogous figures are not available for native cattle; but it can be assumed that they require two gallons of water for each gallon of milk produced.

(5) *Tsetse Fly Belts.* These belts are well recognised and occur chiefly along the river banks where the country is covered with bush and there is the necessary humidity. These areas are never used for grazing purposes so long as grazing of sufficient quantity exists elsewhere, and only when this is exhausted are the fly areas entered. This means that the good pastures which may exist in these infested areas are never grazed when the herbage is in good condition, but only when it is well past its most nutritious stage and when the resistance of the animals to disease is lowered. These areas are numerous and by no means inconsiderable in extent, and in practice the grazing is lost to the herds. The elimination of the tsetse fly would make areas of good grazing available.

(6) *Lack of Outlets for Stock.* There are no outlets for cattle from the Samburu region; exchanges can be made with tribes in neighbouring areas, but even this is limited. Outlets exist for the free movement of sheep and goats from the area, and Somali traders carry out a brisk trade in small stock in return for cash, tobacco, snuff, blankets, maize meal, etc. The sheep and goat population is so vast and they reproduce themselves so quickly that the trade does little more than prevent the flocks from increasing beyond bounds. These flocks of sheep and goats do so much damage to the grazing and vegetation that they should be looked upon more as destructive agents than real assets. The question of an outlet for the cattle herds is bound up with the elimination of disease, for as long as rinderpest, pleuro-pneumonia and trypanosomiasis are rife, an outlet for their stock is denied to their owners.

(7) *Soil Erosion.* The depletion of Kenya's pastures, as exemplified in the Northern Frontier Province in general, is proceeding rapidly and is being hastened by the extension of soil erosion over large tracts. Erosion is brought about mainly by overstocking and over-grazing and by the destruction of the vegetation by the large sheep and goat population, by the collection of large herds and flocks at watering places and by indiscriminate grass burning.

There can be little doubt that this destruction of the Frontier Province's most important asset is not yet fully realised, and it may be that sufficiently energetic steps will not be taken until the destruction is so complete as to make alleviation

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impossible. Even now the task is one of the greatest magnitude and the trained staff necessary does not exist.

The dangerous tendency in discussions of such matters is to generalise. Detailed surveys of each area are essential, since obviously the resources and local conditions vary so much from area to area

The wealth of Kenya is in her soil, from which her agricultural produce comes and on which her vast herds and flocks depend for their existence, and this asset is being impoverished to grow more and to sustain more and ever more stock.

The remedy for overstocking is obviously to reduce the numbers, but the problem is beset by difficulties and any scheme must be attractive to the owners and, therefore, as far as possible devoid of any suggestion of compulsion.

General

The limiting factors briefly set forth cannot be over-emphasized. The decimation of herds from time to time by epidemics of disease renders progress through selective breeding almost impossible, while the quantitative and qualitative nutritional deficiencies and lack of water fix a very low standard for growth and production, beyond which the cattle cannot be improved.

Control of Elimination of the Limiting Factors

The recognition of the visible factors affecting animal husbandry in Samburu is a comparatively simple matter in comparson to suggestions for their amelioration or elimination.

Broadly speaking, the conditions are bad for stock rearing, the stock are over numerous and the outlets are non-existent except for sheep and goats. Improvement must, therefore, develop from within the area itself and must take the form of pasture and water improvements, reduction of stock and the development of outlets once the two first mentioned factors are controlled, or, and this is the more hopeful of two difficult problems, the diverting of the stockowners' attention more to agricultural and less to pastoral pursuits.

To rest the area and allow it to recover from its over-grazed condition, a severe, permanent reduction in stock is necessary, and if much time is allowed to elapse, probably by as much as 50 per cent. To obtain a market for some 60,000 head of cattle is likely to prove an exceedingly difficult matter, politically and economically. The marketing of such a large number of animals, even in the event of the Samburu agreeing to such a course, would upset the industry in the Colony as a whole, and would be likely to meet with lively opposition from the European stock owners. A slow, steady annual exit would have little effect other than to neutralise the normal annual increase.

The export of cattle which is possible from the area is, therefore, not in itself likely to affect the position materially, and certainly not for some time to come, and not at all until the disease position is controlled. The alternative to export of live cattle out of Samburu is the export of meat, either direct from the area or from such suitable part of the Province as may be selected for the erection of a meat factory. The erection of a meat factory for the whole area is, however, not a feasible proposition for two reasons. Firstly, such a factory would be a heavy liability on the Colony's finances, since it would never be self-supporting, as

Samburu would be incapable of the sustained effort necessary to maintain a profitable and permanent flow of cattle to such a factory. Secondly, the difficulty of transport from Samburu's isolated position would, even in the unlikely event of the first mentioned difficulty being overcome, seriously overburden the finances of such a factory.

Further, to what extent the cattle of Samburu are affected with measles (*Cysticercus bovis*) is not known, so that a very important factor in the export of carcases or the local utilisation of carcases is not known.

At this point it might not be inopportune to interpolate that the main difficulties of suggesting amelioration of conditions in this area as in the Garissa area, is the lack of detailed and accurate knowledge of all the influencing factors. No detailed survey of the area has been made, no soil analyses, pasture identification, biochemical estimations, water surveys, dietetic survey or anything of the nature have been carried out, and until such omissions are made good the present state of affairs will remain much as they are. No elaborate scheme for the collection of such valuable data is necessary. Only a small team of workers, a biochemist, a medical dietetician and a veterinarian, based preferably on a nutritional institute at home under the Colonial Development Fund would find a rich field of work and produce an inestimable harvest

The conditions in Samburu and indeed in every area of the Northern Frontier Province are to be seen in practically every district of Kenya. The problem of overstocking is the most serious obstacle to Colonial progress in countries where the people are overwhelmingly pastoral and where, as a result of British Administration, tribal wars have been put down and epidemics of animal disease checked. Wars and epidemics, however undesirable politically, had the effect of preventing the over-expansion of livestock and consequent overstocking. This overstocking must be taken in hand and as Harris and Samson have so admirably stated (1934) " The real problem is not how to increase the area of grazing but how to reduce stock to the numbers which the land can carry without reducing the people to destitution in the process ".

Were the periodic retrogressions by outbreak of disease to be remedied, the gradual improvement of the cattle, more especially in relation to their productive capacity, could be carried out with some prospect of success. Such control would be a big advance, but ultimately the results would be destructive rather than developmental. At present the area is supporting more stock than it can properly carry.

The phase where the hypodermic syringe was the beginning and end of veterinary activities is slowly giving way to a more comprehensive long-range policy. Even so, the policy of wholesale preventive inoculations is not justified in the light of the circumstances prevailing. Disease does naturally what the Government tries to do, but finds difficult to achieve in face of the political hazards. Epidemics of disease in the herds are not occurrences which any veterinarian can look upon with equanimity, but their suppression will lead inevitably to most serious overstocking, and death from virulent disease would ultimately only give place to death from starvation or deficiency diseases. If

preventive inoculations are to be carried out on a wholesale tribal basis, then immediate outlets for the stock must be made available. If this is impossible, as it manifestly must be, then inoculations on a wide scale are not only unjustified but can be reckoned to aggravate rather than ameliorate the present unfortunate position.

Any system of disease control must take cognisance of the other factors. Only the better-grade animals should be immunised, and only these immunised animals should be bred from; the remainder should be isolated by a system of internal quarantine. This system of quarantine could be arranged to fit in with the present native system of "bor" grazing, i.e., the custom of young stock and dry animals grazing in areas distant to the parent village.

Rinderpest presents no great difficulty; the vaccination method with spleen pulp vaccine, prepared in "bor" areas, would reduce its cost to Government and also reduce the stock numbers, since young inferior, non-immune animals would be used. That is, in the preparation of vaccine, the inferior, unwanted stock would be used to immunise the remainder, and as the vaccination would have to be repeated every six months for the immunisation to remain complete, the number of non-effective cattle would be reduced materially. The newly introduced goat virus vaccine might likewise materially assist in clearing up the rinderpest problem.

Pleuro-pneumonia presents a more difficult problem to solve. From the point of view of State Medicine, every animal in the area is suspect. While the owners know the susceptible animals in their herds, their judgment cannot be accepted for obvious reasons, so far as allowing them to leave quarantine and enter "clean" areas. Their judgment might be accepted, however, so far as immunisation and internal quarantine purposes are concerned.

All animals which have suffered from pleuro-pneumonia, together with low-grade animals, would be herded in "bor" in areas set aside for this purpose; the remainder would be immunised and permanently branded with a year brand. The animals, therefore, left unimunised for rinderpest and pleuro-pneumonia would be suspect carrier cases and low-grade susceptibles, kept in "bor" as separate herds in accordance with native custom; and all bulls included in these "bor" herds would be emasculated. Frequent pleuro-pneumonia vaccination would be necessary in order to safeguard calves from possible infection, and since they would bear a brand, they could be sold out of the area safely whenever the owner wished to do so. The pastures would thus be relieved further of stock and with the minimum interference with native custom and wishes.

Quality and Quantity of Food

These two problems are more or less inseparable and their elimination presents difficulties of considerable magnitude. Both questions are bound up in matters which are, to a large extent beyond human control. These are (1) Climatic conditions; (2) Topographical conditions; (3) Ecological conditions.

In most areas the rainfall is scanty and is estimated at 20 inches per annum. Not only is the rainfall limited, but it is distributed very badly, and restricted to two very short seasons during the months of March and April (the "short" rains) and November to December (the "long" rains). This aggrevates

the effects of a low rainfall. Most of the area is very rocky and bare and broken up into steep lava brakes and gorges. Other parts are covered with dense impenetrable bush, wholly unsuited for the existence of cattle. The soil is, generally speaking, of a very sandy, porous nature and appears to be granitic and laval in origin. A soil of this nature, coupled with poor climatic conditions and the destructive habit of indiscriminate grass burning and over-grazing produces a poor type of pasture.

The more undulating country of Leroki provides the best of the grazing land and this small area of about 100 square miles of rapidly deteriorating grazing, has to support about 70,000 head of cattle or more than half the total bovine population. It is perhaps unfortunate that the Northern Game Reserve should include a great deal of the better grazing and the area has a burden of thousands of head of game of all descriptions, including elephant, buffalo, rhinocerus and multitudes of large and small buck whose effects on the pasture cannot be slight.

The area is stocked to beyond the maximum it can carry, and any further animal increase without the provision of outlets cannot have other than very serious consequences.

Water

In the better grazing areas, the water supplies are an improvement on the lower and more arid regions. Lake Kisima constitutes a water supply for a large radius and numerous springs and water holes exist on the Plateau. The only permanent river is the Uaso Nyiro; the temporary rivers provide water in plenty during the rains and by means of water holes dug in their dried courses during the dry seasons.

In many areas, the construction of dams would ameliorate the water problem. These would fill during the rains. Care, however, would have to be taken in their construction on rivers with sandy beds and unless the sand strata were excavated and filled up with a more impervious earth, the seepage, quite apart from the evaporation, would cause a quick loss of water. Large water-holes could be dug elsewhere for surface catchment which would help considerably during the drought. The relationship between such reservoirs or water-holes and disease is fully realised, and the only apparent way of dealing with the problem would be to run the water from the dam into troughs belonging to the individual owners, and in this way lessen the risk of contamination of the water and also prevent the breaking down of the dam walls and the silting of the reservoirs. Such dams, in addition to augmenting the water supply very materially, could be put to invaluable use in small systems of irrigation for promoting the growth of feedingstuffs, provided the latter are protected from the destruction wrought by game. Lucerne, for example, which I had planted experimentally in the same type of country, grew well after initial encouragement by means of irrigation furrows. Maize will grow quite well and can be made successfully into ensilage in simple pit silos, which the natives could make readily. Groundnuts and sunflowers would also grow. Supplementary feeding can, therefore, be produced and stored against the time when grazing is scarce. There are numerous areas where planting could be expected to be successful.

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Tsetse Fly Belts

This problem, while not one of great magnitude compared with some African areas, is by no means a negligible one. The most obvious method of control is by bush clearing in the river areas. Symes has shown that, by making clearings alternating with blocks of bush where the fly can be caught by hand, it is possible to eradicate *Glossina palpalia*. In large tracts of bush, Swynnerton showed that much could be done by grass burning to clear the fly. As grass burning is an uncontrolled practice of the native, and as infested grazing is of very little value, more especially at the grass burning period, such action would not disturb native views and practices.

The writer has some experience of the Harris fly trap and found it to have practically no value under the conditions in which it was used, probably because of the abundance of game in the vicinity. The Harris trap caught many species of flies, but appeared to have little attraction for Glossina.

The labour required for the bush clearing and grass burning is readily available in the area in sufficient numbers. The eradication of game might do much to help the eradication of the fly, but what effect this removal of game hosts might have on the habit of the fly is uncertain. Lack of game might drive the fly further afield in search of domestic stock with results very different from those intended. It seems, therefore, that the only apparent method of control is by eliminating the bush breeding grounds.

Part II of this article will appear in the August issue

RESISTANCE TO ANTIBIOTICS FOUND IN SOME STRAINS OF COMMONLY OCCURRING BACTERIA

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In recent years it has been observed that there is an apparent increase in the proportion of strains of certain micro-organisms which are resistant to some of the antibiotics in general use.

Fleming (1942) reported that occasional strains of staphylococci " were almost insensitive to penicillin ". As the use of penicillin increased, particularly in the field of human medicine, so the occurrence of resistant strains became more frequent. Barber and Dowzenko (1948) studied staphylococci infections in one hospital and over three successive years the incidence of resistant strains had risen to 59 per cent.

Many strains of *Neisseria gonorrhœa* developed a resistance to penicillin following the prophylactic use of that antibiotic.

Streptomycin was the second antibiotic to come into general use and resistant strains soon became apparent, particularly of *Mycobacterium tuberculosis*.

The property of resistance to antibiotics has been studied extensively and it is thought that it may occur in two ways. One method is by the formation of the enzyme penicillinase (Kirkby 1944), by means of which the organism destroys the penicillin in its environment. This mechanism accounts for most of the resistance

found among staphylococci. The alternative mechanism is believed to be by the formation of antibiotic-resistant mutants. Such mutants are thought to be present in very small numbers in most bacterial populations, and their growth is favoured and promoted by the presence of the antibiotic until eventually they replace their antibiotic-sensitive parent cells.

The marked increase in the use of antibiotics in veterinary medicine is now leading to problems of antibiotic resistance similar to those encountered in the field of human medicine. Little work has been published on this increasingly important matter and the purpose of this paper is to record the occurrence of antibiotic-resistance strains found in the dog. As the dog occupies a unique position in the animal kingdom because of its close association with man, its bacterial flora may be greatly intermixed with that of man. No doubt it carries also a vast flora acquired from the soil. As few, if any, of the autotrophic soil bacteria are known to be of pathogenic significance, this study has been limited to common potentially pathogenic groups and to their sensitivity to the five antibiotics now in general use. The investigation has not been undertaken as a specific piece of research work, and this article is presented as a record of information acquired during the course of routine Diagnostic and Consultative work.

Materials and Methods

Three groups of dogs were studied. The first group consisted of 139 healthy dogs. The second of 127 clinical cases from which material exactly comparable to that taken from the first group was examined. The third group consisted of 78 clinical cases in which the material examined was taken from sources other than those included in the first two groups.

Practically all samples were taken by means of swabs, the tonsils, rectum and vagina or prepuce being examined in the first two groups. In the third group the swabs were taken from the ear and skin and from interdigital cysts. The swabs were cultured on 5 per cent horse-blood digest agar, plates being inoculated in duplicate and incubated ærobically and anærobically using a McIntosh and Fildes' jar, at 37° C. for 24 hours or longer if necessary. MacConkey's medium was also used in all cases and digest broth was inoculated with material from some of the clinical cases whenever this seemed advisable.

The plates were examined and selected colonies subcultured for further identification and testing against the antibiotics. Only the following were studied: beta and non-hæmolytic streptococci, *Staphylococcus aureus, albus* and *citreus, Bacterium coli, Proteus vulgaris,* Gram-negative cocci resembling *Neisseria catarrhalis* and some strains of Pasteurella. *Pseudomonas pyocyanea* was included in the first and third groups.

Tests used for identification included the formation of coagulase and pigment by staphylococci, and of soluble hæmolysins by streptococci, beta-hæmolytic strains were also grouped according to Lancefield's technique (1933). Biochemical reactions and sugar fermentation tests (Mackie and McCartney, 1948) were used for the Gram-negative organisms.

The antibiotics tested were penicillin, streptomycin, aureomycin, terramycin and chloramphenicol, all of which were purchased commercially. The testing was done by the gutter plate method originally used by Fleming and described by

Mackie and McCartney (1948). Sensitivity was estimated by comparison with that of the standard strain of *Staphylococcus aureus* Oxford of Heatley (1944), the plates being read after 24 hours of incubation at 37° C. A series of readings were taken and graded as very sensitive, sensitive, slightly resistant and completely resistant. For purposes of clarity in setting out the results in the text, however, these have been abbreviated to sensitive and resistant. The concentration of antibiotic in the gutters was as follows: Penicillin 10, chloramphenicol 50, streptomycin 200, aureomycin and terramycin 25 units per millilitre respectively.

Results

In the first group all the dogs had been examined during the course of the preceding year, when all five antibiotics were in general use. The material for the second and third groups, however, had been collected over the preceding three years, and as aureomycin and terramycin were not used extensively until the latter part of 1954 the observations made in these groups fall into two sections which have been allowed for in the percentage calculations. The observations are set out in detail in Tables I, II and III.

TABLE 1

Sensitivity to Five Antibiotics of Some Bacteria Commonly Isolated from the Tonsils, Faeces, Prepuce or Vagina of 139 Healthy Dogs.

Organism	Total Number of Strains Isolated	Distribution of strains isolated				Percentage Sensitive To				
		Tonsil	Faeces	Prepuce	Vagina	Penicillin	Streptomycin	Chloramphenicol	Aureomycin	Terramycin
beta-Haemolytic streptococci	99	26	18	36	19	88.8	97.9	97.9	97.9	96.0
Non-Haemolytic streptococci	83	37	30	10	6	83.0	100	100	100	95.2
Staphylococcus aureus	51	37	5	6	3	78.4	100	98.0	98.0	94.1
Staphylococcus albus	216	85	55	53	15	98.1	94.4	94.4	93.9	92.6
Bacterium coli	305	110	139	28	28	32.7	97.3	92.5	90.2	84.3
Proteus vulgaris	38	0	35	2	1	13.1	100	100	55.2	42.1
Neisseria catarrhalis spp.	40	30	3	7	0	55.0	100	97.5	97.5	100
Pasteurella spp.	26	9	0	13	4	88.4	100	96.1	96.1	100
Pseudomonas pyocyanea	4	3	1	0	0	25.0	100	100	75.0	100

Discussion

The results shown in Table I would suggest that only a small proportion of the micro-organisms isolated from healthy dogs show an initial resistance to any of the antibiotics used.

The strains isolated from clinical cases, however, tended to show a higher proportion of resistant strains throughout (Table II). This is particularly evident in the non-hæmolytic streptococci and also shows to a lesser degree in the case of *Bacterium coli.*

No significant correlation was observed between the site of origin of the strain studied in these two groups and their sensitivity to any of the antibiotics used.

Strains isolated from cysts, ear and skin lesions showed a percentage sensitivity comparable with either Group I or Group II according to the organism. The yeast Candida (Monilia) is found to occur so frequently in ear infections that, although only a small proportion of the strains isolated had been tested for sensitivity to antibiotics, these few strains were included in this group. Their sensitivty to all the antibiotics used was low.

TABLE II

Sensitivity to Five Antibiotics of Some Commonly Occurring Bacteria Isolated from 127 Clinical Cases.

Organism	Total Number of Strains Isolated	Distribution of strains isolated				Percentage Sensitive To				
		Tonsil	Faeces	Prepuce	Vagina	Penicillin	Streptomycin	Chloramphenicol	Aureomycin	Terramycin
beta-Haemolytic streptococci	46	26	2	0	18	87.0	97.8	100	96.4	96.4
Non-haemolytic streptococci	27	15	4	1	7	59.2	81.4	92.6	90.9	88.2
Staphylococcus aureus	11	6	1	0	4	73.7	100	100	71.4	100
Staphylococcus albus	106	53	5	5	43	70.8	96.2	67.0	92.5	89.4
Bacterium coli	116	51	18	5	42	20.7	94.8	67.2	87.8	89.2
Proteus vulgaris	12	2	3	1	6	41.6	83.3	91.6	30.0	30.0
Neisseria catarrhalis spp.	7	7	0	0	0	57.1	100	100	100	100
Pasteurella spp.	0	0	0	0	0	0	0	0	0	0

These observations seem to suggest that in the dog the percentage of strains of bacteria which are resistant to one or more of the five antibiotics studied, on primary isolation, is relatively low in comparison with some observations made on human strains. The higher percentages observed among strains isolated from clinical cases would suggest either a greater natural resistance among the potentially pathogenic strains of these genera, or a tendency towards the development of resistance by them. In view of the fact that the majority of cases have received extensive treatment from the veterinary surgeon in attendance before material is submitted to this laboratory the second alternative seems the more probable. It is also supported by the evidence of developing resistance seen during the treatment of infections in man, to which reference was made earlier.

The resemblance in sensitivity between strains in Groups I and III, rather than between Groups I and II, might be explained by the superficial location of the lesions. Through the dog's habit of licking its skin, it seems possible that the flora of such lesions is constantly changing, and that, the primary causative organism having been removed by treatment or receded deeper into the tissues, only secondary invading organisms were isolated from the swabs. Only such

organisms as *Pseudomonas pyocyanea* and the yeast Candida, when situated deep in the ear canal, can resist prolonged antibiotic therapy. These explanations are, however, only theoretical and speculative, no experimental work having been carried out to establish them.

TABLE III

Sensitivity to Five Antibiotics of Some Commonly Occuring Bacteria Isolated From Interdigital Cysts, Ear Infections and Skin Lesions in 78 Clinical Cases.

Organism	Total Number of Strains Isolated	Distribution of Strains			Percentage Sensitive To				
		Cysts	Ear	Skin	Penicillin	Streptomycin	Chloramphenicol	Aureomycin	Terramycin
Streptococcus	24	1	7	16	100	100	95.8	100	88.2
Staphylococcus	65	13	11	41	80.0	92.3	92.3	99.5	88.6
Bacterium coli	28	4	9	15	28.5	85.7	89.3	80.0	66.6
Proteus vulgaris	9	1	6	2	33.3	88.8	66.6	25.0	50.0
Pseudomonas pyocyanea	8	0	8	0	12.5	75.0	62.5	16.6	33.3
Candida (monilia) spp.	9	0	9	0	0	22.2	33.3	12.5	12.5

While the mode of action of antibiotics varies, some being bactericidal and others bacteriostatic, at any given concentration, it has been shown by experiments *in vitro* that the sensitivity of most bacteria to any antibiotic varies considerably with the prevailing conditions, and may vary by as much as 1,000-fold according to the size of the inoculum (Dible, 1951). It would therefore appear that the heaviness of a particular infection might be the controlling factor in its response to an antibiotic rather than the degree of its resistance to that antibiotic as determined in the laboratory. This point has been illustrated further in the course of the present study by the large number of strains of all genera which showed varying degrees of sensitivity, but which were far short of complete resistance, with all five antibiotics tested. This fact would therefore confirm Fleming's early observation that for successful chemotherapy an antibiotic must be administered in sufficient concentration, for an adequate period of time.

Summary

The percentage of strains of seven commonly occurring bacterial genera, resistant to five antibiotics in general use, is low among healthy dogs.

A relatively higher proportion of resistant strains was found in some genera isolated from comparable material obtained from clinical cases. In a group of strains isolated from other lesions, tendencies towards antibiotic resistance were shared with the other groups.

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THE EARLY USE OF ANÆSTHESIA IN VETERINARY PRACTICE

By J. F. SMITHCORS*, D.V.M., Ph.D.

ETHER was discovered in 1540 by a German, nitrous oxide in 1776 by an Englishman, and chloroform by a German, a Frenchman, and an American independently in 1831. The anæsthetic properties of nitrous oxide were anticipated by inhalation experiments in 1800, and of ether in 1818, but the demonstration of surgical anæsthesia was not realised until near the mid-century. A pharmacist, D. Waldie, in delivering an address on chloroform in 1847, as reported in the *Veterinarian* (London) for 1848, stated:

> "These facts may be noticed as a remarkable instance of how long men may stand on the brink of a discovery without reaching it, to which subsequent reflection may shew them that many circumstances have pointed."

In 1824, an Englishman, Henry Hickman, had carried the use of carbon dioxide to the point of rendering several animals unconscious, but it remained for a group of Americans in the 1840's to demonstrate the surgical use of anæsthetics. Long a matter of dispute as to priority, the consensus now is that ether was first used in 1842 by Crawford Long, and nitrous oxide by Horace Wells in 1844. Long's work did not come to light until after the publication of William Morton's demonstration of ether as a surgical anæsthetic in 1846. Chloroform was first used by James Simpson of Edinburgh in 1847, whereupon it became the favourite of British medical men, in spite of the higher death rate than with ether.

Despite the demonstration that half an ounce of ether introduced into the stomach of a dog (Orfila: *Toxicologie generale*, Paris, 1813) produced insensibility and death, both ether and chloroform were being used as a vermicide by 1840 for *hoose* (lungworm) in calves. The method employed was to elevate the head and pour two drachms of ether, chloroform or turpentine up each nostril (total—½ oz.). The veterinarian, Robert Read (*Vet.* 1848), says, "In some cases is must be repeated two or three times, but once has frequently the desired effect; and the relief so suddenly obtained seems magical." A full account of this use of ether appears in the *Farmer's Magazine* (London) for 1839. Ether had been used internally in small doses in human medicine a century earlier, and locally as an anodyne for toothache.

Regarding the internal use of chloroform, the editor of the *Veterinarian* (1848), William Percivall, claims, "The credit of first adventuring on the employment of an agent [chloroform] internally. . . belongs, we are proud to say, to our talented correspondent and professional brother, Mr. [Edward] Mayhew." Percivall draws

attention to the fact that Mayhew's work was performed in July of that year; to substantiate his contention, an article on what purports to be the first use of chloroform internally (for cholera) in human practice is reprinted from the *Medical Times* for August 1848. But in an earlier issue the same year, Percivall had published Waldie's article on this history of chloroform in which the author states that his company had filled a prescription calling for chloric ether (chloroform and alcohol) in 1839, and Read apparently had used chloroform as a vermicide in 1840. Waldie states that chloroform was unknown to British pharmacists in 1839, but that its method of preparation was found in the United States Dispensatory.

Mayhew used ether internally for gastric and intestinal inflammation, spasm, and congestion of the lungs and brain, in doses adequate to produce sedation. The one case in which he had used chloroform—as a desperation measure—was that of a horse with colic that did not respond to anything he had tried. His earlier treatment had included: A drench of ether and opium, followed by an enema of the same, later a drench of aloes, ether, opium, aconite and ginger, and an enema of tobacco smoke ! Several hours later, death seemingly impending, he administered six drachms of chloroform in half a pint of olive oil with camphor. In an hour the horse was well.

An early use of ether in anæsthetic doses was in the treatment of tetanus, both in man and the horse. Perhaps the first instance of the latter was that performed at the Alfort Veterinary School in 1847 (*Recueil de Méd. Vét.* 1847; *Vet.* 1848). A horse in an advanced stage of tetanus was anæsthetized on repeated occasions by inhalation and enemas of ether, " with visible amelioration. . . day by day the disease is wearing itself out." In the medical literature, rectal administration of ether anæsthesia was reported in experiments on animals by the Russian, Pirogoff, in 1847, but it appears not to have been put to clinical use until 1884, and then only briefly. Because of unfavourable results, the method was dropped until the early 20th century. In a second case (*Vet.* 1849), " the disease completely yielded to etherization, unassisted by any other medical aid. . . there was consumed the enormous quantity of 26.4 pints." Chloroform was used in tetanus by a British practitioner (*Vet.* 1849) with success in two of three cases, the one being in a " dying state " when first attended. In one case with symptoms " of the most aggravated character ", anæsthesia was induced with drenches and enemas, and maintained for " about ten hours " by inhalation of chloroform. Upon regaining consciousness, " all tetanic symptoms had left him. . . in nine days he returned to his work."

In America, James Carver, a graduate of the London Veterinary College, states in his *Farrier's Magazine*† (1818) that a drench of opium, camphor, ginger, and ether (one ounce) may be useful as an anti-spasmodic in the early stages of *locked jaw*, but that ether was too expensive to be used much in veterinary practice. Possibly one reason for the use of ether and chloroform being slow of adoption in general practice was the cost. In an extract (*Vet.* 1848) from a Belgian medical journal, the author recommends that veterinarians use chloroform for small animals, but for larger animals, " the operation becomes costly. . . on this account, perhaps, veterinarians would give preference to ether, whose price is less, and whose effects are no less certain."

A novel use for chloroform was suggested by a retired medical officer (*Vet.* 1848), who asks, "Among its many uses, may not all the horrors of the slaughterhouse

be superseded by its intervention?" He suggests using a chamber of a size to accommodate a score of animals; their meat, he thinks, "would be more likely to be improved than injured by the sweetness and peculiar flavour of the chloroform," as hams are improved by sugar. In the same issue there is a record of this having been done to a pig, who was "not a whit the wiser for what had passed."

The first reports of experiments on the use of ether as a veterinary surgical anæsthetic appear in the *Veterinarian* for 1847. In January of that year, the eminent practitioner, Edward Mayhew (but in an unsigned article), reported his experiments on dogs and cats. Ether was placed in a flask, to the neck of which a large bladder was attached, and the head of the animal introduced into the bladder. Breathing pure ether in this manner, cats were completely anæsthetized in as little as 10 seconds, dogs required from 15 to 45 seconds to lose consciousness. Minor operations were performed without evidence of sensibility. Mayhew gives a detailed account of the excitatory stage, which left him disturbed, and doubtful over the propriety of using ether. He says:

> "The results of these trials are not calculated to inspire any very sanguine hopes. We cannot tell whether the cries emitted are evidence of pain or not; but they are suggestive of agony to the listener, and, without testimony to the contrary, must be regarded as indicative of suffering. The process, therefore, is not calculated to attain the object for which in veterinary practice it would be most generally employed, namely, to relieve the owner from the impression that his animal was subjected to torture. . . There has been yet no experiment that I know of been made to ascertain the action of the vapour on the horse; but I cannot anticipate that it will be found of much service to that animal."

In the subsequent issue, the editor, Percivall, a graduate physician as well as a veterinarian, stated:

> "For our own part, after perusing Mr. Mayhew's interesting cases, we must confess we augur more favourably of the inferences deducible from them than he would seem to. To us it appears questionable whether the cries emitted by the animals during experiments are to be regarded as 'evidence of pain'."

Apparently determined to test his convictions on the matter, Mayhew, in a subsequent article, records his own experiences upon being etherized. Contrary to the judgment of his dentist, Mayhew "resolved to have a *dens sapientia* extracted, in order to test the effects, thinking it a fit offering for the occasion." He relates that the administration of the ether was a pleasant sensation, and he was completely unaware of his own excitatory state; nor did he realize that after one unsuccessful effort at extraction, he had requested that the ether be used again. After regaining consciousness, three additional attempts were likewise unavailing, but undaunted, Mayhew returned the following day to be etherized again, despite the fact that he had suffered depression the evening before. The experience of the previous day was repeated; but upon a second administration of ether, he became so violent that the dentist and his assistant refused to continue in spite of Mayhew's desire to proceed. The dentist's concern may have been as much for his equipment as for his patient, for Mayhew relates that he unknowingly tore the dental chair apart. With considerably more than most investigators to back up his convictions, Mayhew concluded that ether did have a place in veterinary surgery, but warned, "We should be cautious lest we become cruel under a mistaken endeavour to be kind."

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The first report of the use of ether on a cow (*Vet.* 1847) was a case which required the amputation of the leg at the hock. Four ounces of ether were used, 17 minutes being required to produce unconsciousness. The operation was performed without evidence of sensibility, and the animal recovered. Later experiments at the veterinary college, in which the use of pure ether rendered horses unconscious in less than two minutes, proved the necessity of using an admixture of air and ether. Efficient inhalers were developed by veterinarians as early as 1848, paralleling or antedating similar inventions for human use. The first good inhalers for both ether and chloroform in medical practice were made by the eminent anæsthetist, John Snow, in 1858. The number of accidents, which Mayhew had anticipated in his first communication, led Percivall to urge veterinarans " to lose no time in bestirring themselves to ascertain what may or may not be done, so far as their patients are concerned, by the ethereal stifler of pain and sensibility. . . It is now notorious enough that both men and horses have succumbed, under the influence of ether, to rise no more, and, as post-mortem examinations of their bodies has shewn, *in consequence* of such influence."

With the discovery of the anæsthetic properties of chloroform by the noted obstetrician, James Simpson, and his replacement of ether by it in November, 1847, the " ether mania " died down. In an article entitled " Ether Superseded ", reprinted without comment in the December (1847) issue of the *Veterinarian*, the advantages of chloroform were extolled by a medical writer : " Its advantages over ether are so varied and palpable that the latter may be considered as already superseded." Thus he claimed that a smaller quantity would produce the same effect with less expense, less excitation, and greater pleasure to the patient.

That veterinary interest in this new agent developed immediately may be adduced from the fact that the first record of the experimental use of chloroform in veterinary surgery was reported in the *Veterinarian* for January, 1848. Two ounces of chloroform on a sponge produced complete anæsthesia of a lame horse in five minutes: " the usually painful operation of cutting the nerves of sensation in both its front feet. . . [was performed] without a quiver. In twenty-five minutes from the commencement the animal was again on its legs, now perfectly sound." The second communication deals with the use of chloroform in castration, for the administration of which the veterinarian had devised an inhaler in the form of a tin muzzle. The effectiveness of the anæsthesia may be judged from the remark of a farmer, who observing the unconscious animal on the ground, exclaimed, " He's dead, he's dead! I will not give a shilling for him." To his surprise the animal was on its feet in a few minutes, unaware of what had happened.

Another veterinarian who had experimented (1848) with chloroform for neurotomy concluded:

> " It is, in my opinion, very doubtful whether chloroform will ever become an efficient agent in veterinary practice on the horse, as I believe these two bad-conditioned animals [operated upon] suffered more in being reduced to a state of insensibility, and in recovering from the state, than they did from the operation performed."

In a similar vein, Percivall, in his editorial capacity, suggests that experiments on dogs and cats " in the days when ether had so great a name as an anæsthetic ", did

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not hold much promise of utility in veterinary practice. " Time ", he says, " . . . has pretty well verified this prediction in the case of ether; nor, as yet, in the case of chloroform . . . has much better success followed . . . there exists the greatest danger of [the horse]. . . in his delirious moments, throwing himself headlong upon the ground, and doing himself irreparable injury. . . The eminent William Field, from a conviction of the risk. . . very properly refuses, on his own responsibility, at least, to subject any horse on whom he may have to operate to the influence of chloroform."

By this time the number of unfortunate accidents and deaths of animals subjected to anæsthesia had accumulated to the point that veterinarians apparently had become disenchanted of the bright promise they had hoped for. The *Veterinarian* for 1847 carried 17 articles on the use of ether and three on chloroform; in 1848 there were three articles on ether and 13 on chloroform; in 1849 there was but one article on ether and two on chloroform, all three being on the use of these agents in tetanus rather than anæsthesia as such. The cycle was complete, for as pointed out by a practitioner in regard to the numerous " cures " for tetanus (*Vet.* 1835),

> "We very often delude ourselves in regard to the operation of medicines, which seldom effect what we suppose them to do. For his reason it is proper that we should be sceptical with regard to new remedies, which hardly ever maintain the character bestowed upon them by their first employers."

In America, George H. Dadd appears to have been the first veterinary practitioner to use ether or chloroform for surgical operations. Dadd had turned from human to veterinary practice about the time ether had been demonstrated in Boston, and perhaps to a greater extent than the few graduate veterinarians in America (15 in 1847) at the time, kept abreast of medical development. Dadd had used ether as early as 1852, and in his *Modern Horse Doctor* (1854) urged its use in all painful operations. For neurotomy he says,

> " We recommend that, in all operations of this kind, the subject be etherized, not only in view of preventing pain, but that we may, in the absence of all struggling on the part of our patient, perform the operation satisfactorily, and in much less time after etherization has taken place than otherwise. So soon as the patient is under the influence of that valuable agent, we have nothing to fear from his struggles, provided we have the assistance of one experienced to administer it. We generally use a mixture of chloroform and chloric ether in our operations, and consider it far preferable, so far as the life of our patient is concerned, to pure chloroform."

Despite the opprobrious title, Dadd's was the first native American work to call for humane treatment and the application of scientific principles in veterinary practice. While his works sold widely, it would appear that the chief interest was in his cures; few practitioners exhibited the curiosity requisite for scientific practice. Horses continued to be bled and purged with vehemence, and operated on without benefit of anæsthesia.

If European veterinarians found ether and chloroform something less than the easy panacea these agents had earlier promised to be, at least there was a spirit of scientific enquiry which a few pursued toward the sometimes illusory goal. Perhaps it was too much to expect that American practitioners, without the stimulus of veterinary schools or a veterinary periodical literature, would look beyond the day-

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to-day work, too often performed in yesterday's manner. At any rate, it was not until after the turn of the century that, fortified with the necessary adjuncts to scientific practice. American veterinarians began to look to anæsthesia as an essential part of practice. The latter half of the 19th century was not a complete void in this respect, however.

An interesting, but apparently obscure, report on "Etherization of Animals was published in the *Report of the Commissioner of Patents, Part 2, Agriculture,* for 1853. This appears to be a record of the first use of ether on animals, for the author, Dr. C. T. Jackson, who had demonstrated its use in human surgery, states,

> "In 1846. . . I also indicated its use in preventing all sensation in domestic animals, upon which surgical operations were to be performed. . . The means is easy, safe and efficient and any intelligent person can administer the ether as I shall describe. . . In administering ether and chloroform to animals, I make use of a wire muzzle, or basket, which is fastened round the nose and mouth, and fixed in its place by proper straps . . . The basket [containing a sponge] being put in the proper position, I take this mixture—pure sulphuric ether, one pint; pure chloroform, one gill—and mix them in a bottle; then I pour upon the sponge, from time to time as needed. . . The animal breathes it freely into the lungs, and soon gently falls down in a sleep of insensibility and unconsciousness, and is entirely passive, so that any operation may be performed, and without any struggle of the animal, or any signs of pain."

Jackson states that he has anesthetized horses, cattle, sheep and dogs, but that cats are too readily killed by chloroform. Jackson's article also appeared in the *Country Gentleman* for 1855, but it apparently excited little interest, for in an exhaustive survey of writings of veterinary interest in the American agricultural journals from 1850 to 1875, only three other articles on the subject, among some 3,000 references were found.

In one of these (*American Agriculturalist,* 1850) chloroform was considered of no value in castration of horses because it produced "madness". In the same journal for 1864, the editor advocated its use, as it allowed the veterinarian to perform difficult operations with ease. Application by pouring chloroform on a towel and holding to the nose was suggested, with precautions against the dangers of an overdose. In a discussion of "Spasms of the Bowels" (*Prairie Farmer,* 1863), it was mentioned that it was necessary to administer chloroform and ether to quiet the struggles of the animal so it could be treated.

The only other references to the use of anæsthesia found in any periodical at this time are those in the *American Veterinary Journal*†. Being edited by George Dadd, it is not surprising that the use of anæsthesia should be advocated Thus in volume 3 for 1858, for the "Cæsarian Operation on Sows", "Humanity would suggest that the subject be etherized, when performing so formidable an operation, yet our experience in the use of anæsthesial agents on swine, will not warrant us in recommending its universal application.". In the article on colic, Dr. Robert Wood, an associate of Dadd, indicated that he used ether internally in preference to opium as a soporific. A case of tetanus in a horse, which had not responded to other treatment, but did so upon giving inhalations of chloroform, is reported from the *Veterinarian* (London). Ether was recommended as the best means of controlling puerpural convulsions. In the removal of a tumor from the penis of a horse, a

mixture of equal parts of ether and chloroform, " rendered the animal completely insensible to pain ". From a note on " Doings at the Dissecting Room of the Boston Veterinary School ", it is evident that Dadd taught the technic of anæsthesia as a regular procedure.

Anæsthesia had at least a few other advocates among the veterinary profession at this time, for Robert Jennings, founder of the ill-fated Veterinary College of Philadelphia (1855), in his book on *The Horse and His Diseases* (1860), states:

> " In severe operations, humanity dictates the use of some anæsthetic agent to render the animal insensible to pain. Chloroform is the most powerful of this class, and may be administered with perfect safety, provided a moderate quantity of atmospheric air is inhaled during its administration. Sulphuric ether acts very feebly upon the horse, and cannot therefore be successfully used."

The only operation for which Jennings specifies the use of anæsthesia, however, is that for hernia. On the other hand, Williams, in his *Principles and Practice of Veterinary Surgery* (American edition, 1882), says nothing of the use of anæsthesia for hernia operations, specifying instead, " a powerful internal sedative ". The only mention of anæsthetics by Williams is "full chloroform anæsthesia" for lithotomy, and for amputation of the penis. As a matter of passing interest, Jennings states that all that is required in the latter operation is " one swift bold stroke of a sharp knife ".

In Navin's *Veterinary Practice, or Explanatory Horse Doctor* (Indianapolis, 1873), the author, a veterinary surgeon writing for the laity, states, concerning chloroform:

> " It is much used in human practice, in performing surgical operation. . . Chloroform may be administered to the horse for the same purpose as it is given to man. An experienced finger should be on the pulse while the horse is breathing [sic], and if the pulse should be about to stop, the chloroform should be removed from the nose, and a handkerchief wet with aqua ammonia held close to it. The quantity required to get the horse under its influence will vary from one to four ounces. I would not recommend its use in any but the more important operations."

This information appears in a " list of medicines ", and Navin does not refer to the use of chloroform as an adjunct to any operation; inasmuch as his book was " intended for the use of the farmer, and not for the professional horse doctor or veterinary surgeon ", this omission may have been a fortunate one for the horse.

Professional veterinary writings during the last quarter of the 19th century, however, demonstrate a conspicuous lack of interest in anæsthesia on the part of veterinarians. In the first volume of the *American Veterinary Review* (1877), for example, there is but one reference to anæsthetics, and none in volume two. Although not quite in this category, there is a three-line reference to a " partial intoxication " of a horse with drenches of wine to facilitate clipping—" Would it answer for minor operations? " The answer apparently was forthcoming, for in a later issue it is reported that a milk and whisky punch was administered as an adjunct to urethrotomy in an ox. The one *bona fide* case is by Dr. Alexander Liautard, who reported using ether and chloroform in an unsuccessful attempt to reduce a dislocated patella.

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With the publication of American editions of Dun's *Veterinary Medicines* in the 1880's, veterinarians at least had the opportunity to become acquainted with the properties of chloroform and ether. The 1886 edition devoted some 15 pages to these two agents. While the actions and uses of both are given in great detail, Dun states, however:

> "Chloroform is not so extensively used in veterinary as in human medicine. It is occasionally given to horses to procure insensibility during castration, firing, and other painful operations but it is wise to warn the owner of the risk attending its adminstration. . . Ether closely resembles chloroform. . . In veterinary practice anæsthesia, however, is not always so rapidly and successfully effected; some well-bred horses require to be cast before they can be got to inhale the anæsthetic; the preliminary stage of excitement is occasionally prolonged for some minutes; whilst, for many hours, and even for a couple of days, some patients continue dull and off their feed."

Summary

Veterinarians were quick to experiment with and make use of ether and chloroform in clinical practice upon the demonstration of surgical anæsthesia in the mid-nineteenth century. The reasons for veterinarians later being reluctant to make any considerable use of general anæsthetics are not immediately apparent. Evidently some had tried them and, for various reasons, found them wanting. Although much progress in anæsthesiology had been made in human medicine, veterinary clinical teachers took few steps to include this adjunct to surgery in school practice. Whether this was based upon unsatisfactory personal experiences with general anæsthetics, or perhaps a lack of experience or acquaintance, is a moot question. It is likely that more than a few simply thought of anæsthesia as an unnecessary refinement to a practice where a heavy hand was accounted a major asset. Whatever the case, the fact remains that general anæsthesia did not achieve much popularity until after the efficacy, and shortcomings, of local anæsthetics were demonstrated early in this century. Whether it be accounted in the name of humanity to the animal, or for the safety and ease of the surgeon, the relatively recent development of high caliber technics of anæsthesiology must be considered a major advance in veterinary medicine.

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† Two issues 1818.

† Four volumes 1851-1858.

NEW ASPECTS OF EQUINE LAMENESS

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SOME extremely interesting cases of lameness in horses which were resolved following antibiotic therapy have come to my notice.

Case (1)

A four-year-old thoroughbred diagnosed as suffering from a nerve lesion. The lameness had been in existence for some months. The horse had been subjected to various forms of treatment with no response. A blood examination was carried out. A positive agglutination against *B. viscosum equi* and beta-hæmolytic streptococcus was reported. Penicillin and streptomycin were given, in full doses every three hours. There was some indication of improvement. The improvement encouraged the veterinary surgeon to carry on with antibiotic therapy. At this point I was consulted and I recommended ¾ G. Terramycin intramuscularly at intervals of twelve hours over a period of three days, giving a total of six injections. The response was quite dramatic. The horse was much better after twenty-four hours and after one week was sound.

Case (2)

A four-year-old Arab pony mare which was being prepared for show. She was lame in the off hind limb. There was a considerable amount of muscle wastage. The lameness was not continuous but was of an acute intermittent character. At times the mare was going on three legs. On resting the lameness resolved but it came back again. Blood tests were positive for *B. viscosum equi*. 0.5 G. Terramycin was administered intramuscularly every twelve hours, a total of eight doses being given. There was a dramatic recovery. Before the treatment was completed there was a complete absence of all signs of lameness. It is now nine months since the treatment was carried out and there has been no recurrence of the lameness.

Case (3)

A yearling colt had chronic neonatorum infection as a foal—joint ill. The diagnosis in this case was a partial paralysis of the popliteal muscles. The blood tests were positive for beta-hæmolytic streptococcus and *B. viscosum equi*. Treatment and dosage rates, as in case 2, were given with the same result of rapid improvement, in spite of the chronic nature of the condition.

Case (4)

A nine-month-old thoroughbred foal which exhibited signs of "jink back". The condition was quite chronic by the time blood examination was carried out. There was agglutination against *B. viscosum equi*, and a course of Terramycin treatment gave a satisfactory result in a short time.

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Case (5)

An established neonatorum infection at three days of age. This young colt foal subsequently developed a chronic enteritis: streptomycin and injections of vitamin B_{12}, were given. The animal was seven or eight months old by the time the blood examination was carried out, and this showed agglutination against *B. viscosum equi.* Terramycin was given. The colt was very well bred and the owner wanted to save it if possible. The treatment was completely successful in that the clinical condition cleared up, but the foal never made good as a racehorse. It has not had a recurrence of the enteritis.

These cases are an indication that this type of infection should be considered in some of the very puzzling cases of lameness that are met with.

A few other cases of favourable response to antibiotic therapy deserve mention. Some good results have been obtained in cases of fistulous withers which have been established as being associated with *Brucella abortus* infection.

I mention two cases: that of a Shetland pony weighing approximately 400 lb., and a saddle horse weighing approximately 1,400 lb. Both were very chronic cases by the time that Terramycin was administered. The intravenous route was used initially at about 1.5 mg. per pound of body weight, with maintenance dosage intramuscularly at the same rate per pound of body weight.

The Shetland's course of treatment extended over a period of about six days, and the saddle horse over a period of seven days. Both recovered rapidly and were completely sound by about a month after initiation of treatment. Surgical intervention had been carried out—but unsuccessfully—before Terramycin treatment.

The third case was a six-year-old thoroughbred. It was a very early case and the agglutination test was positive for *Brucella.* Terramycin was given by the intramuscular route. Dosage rate was 1 mg./lb. body weight and after three days the animal recovered. The Terramycin was given at twelve-hourly intervals.

I would like to discuss steroid therapy in horses, particularly in relation to arthritis, teno-synovitis and bursitis.

The steroid hydrocortisone is a corticosteroid produced naturally by the adrenal cortex. It is considered to be the most potent of the naturally occurring steroids, about 50 per cent. more potent than cortisone. It is most potent particularly in its anti-inflammatory action. It produces this effect by reducing hyperæmia, cellular exudation and infiltration, the proliferative changes and swelling and pain, the usual classical symptoms of inflammation. It is in this way that its success in the conditions that I am going to mention can be explained.

It is sometime since the first indications were given of the efficacy of the intra-articular administration of hydrocortisone in man. As a result of this work investigations were started in animals and these have been going on for about 3½ years. It was used first in America and their results have been confirmed in this country. The results are quite astonishing.

Clinical cases of joint inflammation have responded and apparently maintained this response—often a permanent cure results after one or two treatments by intra-articular administration of hydrocortisone.

By tradition, arthritis, bursitis, etc., in horses are treated by application of blisters and/or by firing. The value of this form of treatment is, in my opinion, very

limited, much of the benefit resulting from the enforced rest that occurs. Veterinary surgeons dislike intra-articular injections because of the fear of introducing infection, but the procedure is fairly straightforward and simple, even without any nerve-blocking or infiltration anæsthesia. There is very little risk of septic arthritis resulting when normal aseptic techniques are employed and particularly when an antibiotic is combined with hydrocortisone.

First some of the synovial fluid is withdrawn from the inflamed part. This gives a very good indication as to what the condition is, by the nature of the material that is withdrawn. If the fluid is clear and viscid, you can assume it is of inflammatory origin. If cloudy and rather watery, one suspects an infection. Bacteriological examination of this type of fluid will often reveal a streptococcal infection.

Remarkable results have been obtained in America, and have been confirmed in this country. The following is a break-down of the treatment of a series of cases in one practice in America (Wheat, California).

Condition	Species & No. of cases	Complete Recovery	Improvement	Failure
Osteoarthritis of Stifle	2 cattle	-	-	2
Synovitis of Fetlock joint	39 horses	27	11	1
Synovitis of Carpus	21 horses	13	7	1
Osteoarthritis of Carpus	8 horses	-	6	2
Tenosynovitis of Deep Flexor Tendon	1 bull Hock 6 horses	5	2	-
Synovitis of Tarsal joint	10 horses	7	3	-
Navicular bursitis	1 horse	-	-	1
Tendonitis	6 horses	1	5	-

A period of six months had elapsed since treatment, indicating that results were at least more than temporary. An astonishing thing has been that where complete recovery has ensued it has generally been the case that the animals have been sound after two or three days. Unfortunately these materials are still rather expensive, but in a thoroughbred practice where valuable animals are treated, on the basis of these results and dosage rates used, it would be well worthwhile employing such treatment.

(This is the text of an address given to the B.V.A. Divisional Meeting of the R.A.V.C., at Folkestone, February 2, 1957.)

CEREBRO-SPINAL SETARIASIS

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SOME facts of historical interest about cerebro-spinal setariasis have appeared recently in the literature (Shoho, 1953, Pillai and Seneviratna, 1954). According to Dujardin (1845) *Setaria* was observed by Abildgaard in the meningeal membrane of horses. Railliet (1895) described a paraplegia in a donkey and found tracks in the marrow of the spinal cord. The condition is presumably referrable to setariasis though Railliet at the time conjectured it was attributable to *Filaria hæmorrhagique*. Shoho (1953) quotes a paper by Schwangart (1918) entitled "Ursachen der endemischen Parese des Rotwildes", in which the latter is reported to have described the disease and identified the nematodes found in the subdural space as *Setaria labiato-papillosa.*

I want to add to the above quoted references an important reference by Place (1911) who, it appears, had reached definite conclusions on the relationship of ocular filariasis and paraplegia in horses, cattle and buffaloes with *Setaria.* Quoting from Place, "The leading post-mortem features in a case of kumree in a pony are: Congestion of the kidneys, and the meninges of the spine, localised as a rule, but in very bad cases more or less general, softened and congested areas affecting portions of the spinal cord, frequently the presence of adult worms in these regions, and invariably the presence of the ova of filaria papillosa, the nematode found in the eye in cases of worm in the eye. The worms I have examined appear to be filaria papillosa, but vary in size, ranging from 20 to 40 mm. and it is possible there may be more than one parasite affecting the meninges, but filaria papillosa is undoubtedly the most common and the usual concomitant of 'Kumree', and I believe is the cause of the disease".

A suggestion regarding the possibility of ocular setariasis having causal relationship with kumri is mentioned by Innes (1951) and by Pillai and Seneviratna (1954). On the other hand, Place appears to have suggested this relationship as early as 1911.

The claim of Mohiyuddeen (1955) to have noticed cerebro-spinal nematodiasis in cattle for the first time does not stand substantiated in literature. Quoting again from Place, "In Burma ocular filariasis both internal and external is very common, and associated with it a weakness of the loins which renders the oxen unfit for draft, and so they are sent to the slaughterhouse.

"I marked down two hundred cases which showed symptoms of either worm in the eye or lumbar weakness or both, and after three days detention and observation, I examined the spinal meninges as the halves hung on the slings and in every case I found the worms present, while they were absent in the control or non-affected animals slaughtered at the same time, and in no case have I found the worms unless accompanied by lumbar weakness during life".

Place noticed the disease in 20 male buffaloes slaughtered for inability to haul timber on account of weak backs, and reported having found the worms in the meninges.

The association of worm in the eye, paraplegia and cerebro-spinal setariasis was established by Place, and the credit for reproducing the disease experimentally goes to the Japanese workers Yamagiwa, Shoho, Tanaka and others as mentioned by Innes (1951).

This condition has been observed by the author in Punjah-Pakistan in bullocks and horses and, since it has been noted only in male cattle and buffaloes used for plough or draught, it is possible that draught work precipitates the condition.

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REVIEWS

ERBPATHOLOGIE DER LANDWIRTSCHAFTLICHEN HAUSTIERE. Paul Koch, Helmut Fischer and Hildegund Schumann. Paul Parey, Berlin and Hamburg. Price £4 8s. 6d.

THE authors, who have themselves contributed to knowledge of their subject, have earned the gratitude of all concerned with hereditary defects and lethal factors in farm animals by making this comprehensive and critical review of the literature. They point out the limits of present knowledge, and indicate where future work might be directed most profitably. A great deal of information is presented in an orderly and interesting fashion, and the book will be a valuable reference work.

Successive chapters deal with known or presumed inheritable disease conditions of the ox (100 pages), horse (39), pig (64), sheep (42), goat (36) and poultry (including references to turkey, pigeon and duck) (116 pages). The latter part of each chapter is devoted to an account of lethal factors in the species concerned. The authors indicate the mode of inheritance, where known, of the various conditions dealt with, but it is clear that much more information is needed about many conditions. There follows a useful glossary of technical terms, a bibliography of some 1,300 items and an index. There are over 200 illustrations.

As a second edition is bound to be called for, the following suggestions might be made. An introductory chapter on hereditary disease in domestic animals in general would be of interest, surveying the broad comparative features in the different species, assessing the importance of the problem in relation, say, to artificial insemination, and in general preparing the non-expert reader for the more detailed information to come. The dog and the cat might be considered for inclusion in the list of species dealt with. At the end of the book, the various conditions dealt with might be listed in tabular form, with explanations of the

technical names and a statement of the mode of inheritance where known. This table would facilitate quick reference and could replace a formal index. In the bibliography, in which the authors are listed alphabetically, their names would be found with greater ease if they were printed in heavier type than the rest of the references.

The authors can be congratulated on a task performed with considerable success. The turn-out of the book is up to the publishers' usual high standard.

THE CONFORMATION OF THE DOG, by R. H. Smythe, M.R.C.V.S. Popular Dogs Publishing Co., Ltd., London. Price 18s.

IT seems to be a national attribute that most Britons can recognise a good dog or horse by its shape or form. Some can recognise the same thing in the other domesticated animals also. It is relatively easy to appreciate quality thus far, but trouble arises when a number of animals have to be scanned and placed in order of merit. This job can be done satisfactorily only by an experienced "Judge". Judges have great responsibility for their awards set the trend for future developments. On the whole they do their job well and the choice animals that we see today are in great measure the direct result of their perspicacity. Now this is remarkable for few judges can have any great knowledge of anatomy, and some are entirely ignorant of any structure beyond the skin. Mr. Smythe has attempted to remedy this defect by relating form and action to anatomical structure, environment and job.

Every page of this book may be read with profit by a Veterinary Surgeon or by a comparative anatomist, but I doubt if a layman, and most judges are laymen, will be able to understand many of the arguments for comprehension depends on a quite extensive anatomical and physiological knowledge. Those who have such knowledge cannot accept all Smythe's statements and theories. For instance, is the infra spinatus under the scapular, do bones vary very much in chemical composition and is the Pisiform on the inner side of the wrist (human).

The illustrations on page 70 show the lower end of the humerus the wrong way round. Is a round chest best? Is not depth of chest the best criterion? He makes no mention of a simple test of chest and heart capacity, i.e., the girth should exceed the animal's height at its withers Is it a fact that dogs cannot breathe through their mouth (page 78)? They undoubedly do so as soon as they are exerted. Are straight stifles and hocks good points or bad? Most people think they are bad. They certainly raise the croup and enhance direct speed, but joints which are unnaturally arranged become focal points for injury and disease. The human knee has lost all pretence to a bend and in consequence a football player may damage it easily if he runs the length of the pitch. Bulldogs and the "Scottie" breeds have straight stifles and don't they have trouble? On page 128 which lady showed quality? Perhaps as Dr. Joad would say "It all depends what you mean by quality".

There are many more points which might be taken up with the author, but none of them detract from the value of the book for its best quality is that it makes one think. Dogs, like other domestic animals, have been assessed on form and action for many generations and by people devoid of much anatomical knowledge.

Anatomical knowledge should be an advantage. It may not be necessary. Experience seems to suggest that it is not necessary for few veterinary surgeons have achieved fame as judges. Often the best horse or dog in a class can be spotted by the eye as it enters the ring. In most cases a more critical examination only serves to confirm the first impression. On the other hand working dogs and hounds can be judged on performance, and good performers are often the poorest according to exhibition standards of shape and action.

This short review may appear to be hypercritical. Criticism is a good thing and in this case it will be especially so if it incites veterinary surgeons to read this book. If they read it they will exercise their minds and profit thereby.

A RED ROSETTE, by Geoffrey Lapage. Burke Publishing Co., Ltd., 55 Britton Street, Clerkenwell Road, London, E.C.1. 8s. 6d. nett.

MOST veterinary surgeons associate the name Lapage with academic tomes and erudite discussion. Those who know him intimately are well aware that this is only part of the story and that he has a great variety of interests, away from his little animals, and that he is a raconteur of no mean merit.

Like many others he has a daughter and most modern girls are horse and pony enthusiasts. No doubt Jennifer is not an exception to the general rule, and Dr. Lapage has been subjected to much "horse" talk and prodded to write this book. It is a pleasant and exciting little tale about two young horse-lovers. Susan Cameron and Peter Gibson and their ponies Dusty and Blaze. Susan is staying at a farm, Peter is the local doctor's son. Out for a ride Susan sees the beginnings of a fire at the farm and after a hectic ride brings help and all is well. In gratitude Mr. Wallace, the farmer, gives Dusty to Susan. There are further adventures including one with a ferocious bull. Susan's great problem, which is not solved until the end of the story, is, will her parents let her keep Dusty? As she wins the Musical Chairs competition at a Gymkhana and wins a Red Rosette her parents arrive on the scene and all is well. Boys and girls in veterinary homes will enjoy this book. I have a suspicion also that their parents, curious to see what Dr. Lapage has written in an apparantly unusual sphere, will pick up the book, get interested, and read the lot.

SALMONELLOSIS IN ANIMALS, A REVIEW, by A. Buxton, 1957. Pp. 209. Review Series No. 5 of the Commonwealth Bureau of Animal Health. Price 25s.

ONE of the more forbidding aspects of our present knowledge concerning the Salmonella is the disconcerting amount of information which has been accumulated about the serology of these organisms. Indeed, Dr. Buxton in his review "Salmonellosis in Animals" has been obliged to devote no less than 56 entire pages to tables giving the antigenic structure of the 336 types for which details were available (including 24 recent extras) and reports of their isolation from various host species. The catalogue reads almost like a world gazetteer, for most of the species are named, according to the fashion, after the place where first isolated (one imagines with pleasure the dilemma which would face the discoverer of a new rival for the name of, say, *Salmonella tel-el-kebir!*) No wonder the author complains that it is impossible to construct and publish an up-to-date list.

For the purpose of disease diagnosis and control it is rarely necessary to

identify an isolated strain further than assigning it to the genus *Salmonella*, for with certain exceptions the diseases produced by the different serotypes are very similar; few serotypes have even any great host-specificity. One solution Dr. Buxton suggests might be to abandon (*pace* Kauffmann) the detailed identification of most serotypes according to their flagellar components, and to group strains according to somatic antigens only. Detailed identification might be reserved for a few types such as *S. typhimurium* which can from time to time be of serious economic or public health significance in particular areas.

Whether one agrees with this view or not, the author should be congratulated on a comprehensive and critical survey of the subject. Chapters are included on the clinical features and epidemiology of Salmonella infections, the use of antibacterial agents in treatment and control (dosage rates are given except where these are common knowledge) and public health aspects. The book is certainly a worthy addition to the series.

NEWS

HARVEY TERCENTENARY CONGRESS BANQUET AT FOLKESTONE

PAGEANTRY of the Elizabethan age helped to make a memorable occasion of the Harvey Tercentenary Congress Banquet held at Folkestone on Saturday, June 8, 1957. (Harvey was born at Folkestone in 1578.)

The banquet, one of the highlights of the week's celebrations arranged by the Harveian Society of London in memory of William Harvey, took place in a period setting. The menu, the decor of the banqueting hall, and many other features were Elizabethan.

A group of singers sang madrigals. One of the madrigals was in Italian—in honour of Professor dalla Volta, of Padua University, the university where Harvey was awarded the degree M.D. in 1602.

Speeches after dinner included a toast to "Folkestone" by Sir Geoffrey Keynes, surgeon and medical historian. The Mayor of Folkestone, Councillor L. Victor Fowler, replied. He announced that Sir Winston Churchill, Lord Warden of the Cinque Ports, had sent a telegram of greetings to the Congress. The Mayor said that William Harvey was a true son of Folkestone. Folkestone forgot neither its sons nor its traditions.

He referred to the fact that the home of William Harvey was also the home of Messrs. Pfizer, manufacturers of many modern antibiotics. Messrs. Pfizer had awarded an annual scholarship of £130 5s. 0d. to the Harvey Grammar School. This was the amount left by Harvey for the purchase of the original school property. He thanked Mr. R. C. Fenton, Managing Director of Pfizer, Ltd., and his fellow Directors, for the award, which would be a constant reminder that the school had a new benefactor.

The toast of "William Harvey" was proposed by Professor D. N. Dunlop, President of the Harveian Society of Edinburgh.

Replying, Mr. Dickson Wright, President of the Harveian Society of London, thanked the Mayor of Folkestone and Messrs. Pfizer for the hospitality that the Society had received. He presented a silver salver to Dr. Geraint James, their

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Secretary, to mark their appreciation of his work for the Society. He presented to the Mayor a medal which had been struck as a special memento of the Society's visit to Folkestone.

Other distinguished guests at the banquet included Dr. Louis Chauvois of Paris (author of a new biography of William Harvey), Sir Zachary Cope, Professor A. dalla Volta (University of Padua), Sir Cecil Wakeley (Past-President of the Royal College of Surgeons) and Mr. R. C. Fenton (Managing Director of Pfizer, Ltd.).

SMITH KLINE & FRENCH LABORATORIES, LTD., of 120 Coldharbour Lane, London, S.E.5, announce the appointment of Mr. F. G. Brown, M.A., M.R.C.V.S., as Veterinary Adviser. Since 1951 Mr. Brown has been in General Practice. Previously he was on the staff of the Royal Veterinary College, London.

NOTICES

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